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(54) Fast deflation valve for a hot air aircraft.

(57) The fast deflation valve, used for high wind speed landings, is provided by pulling a parachute (4, Fig. 2) downwards from the centre. To achieve this movement, a lock 56 is first released which permits the retaining lines (6, Fig. 2) to be pulled towards the centre of the parachute. The lock is centrally located outside of the parachute and connected to the top of the parachute, so that pulling the operating line (50, Fig. 2) causes the lock to release. Locking lines 51 connect the lock to the outer ends of the retaining lines. An arming system is provided which, when installed prevents the lock from releasing and consists of a separate arming line (63, Fig. 4) and an arming pin (64, Fig. 4). The downwards movement of the parachute, once the lock has released, is restricted by stopping cord (62, Fig. 4) and stopping rings 54. Release of the locking lines allows the retaining lines to lengthen and hence open a large hole for hot air escape.

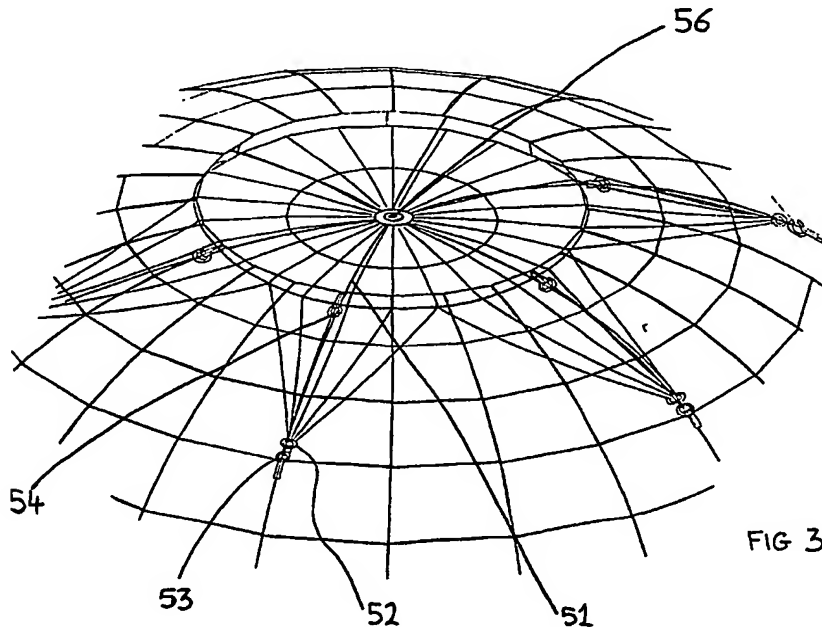


FIG 3

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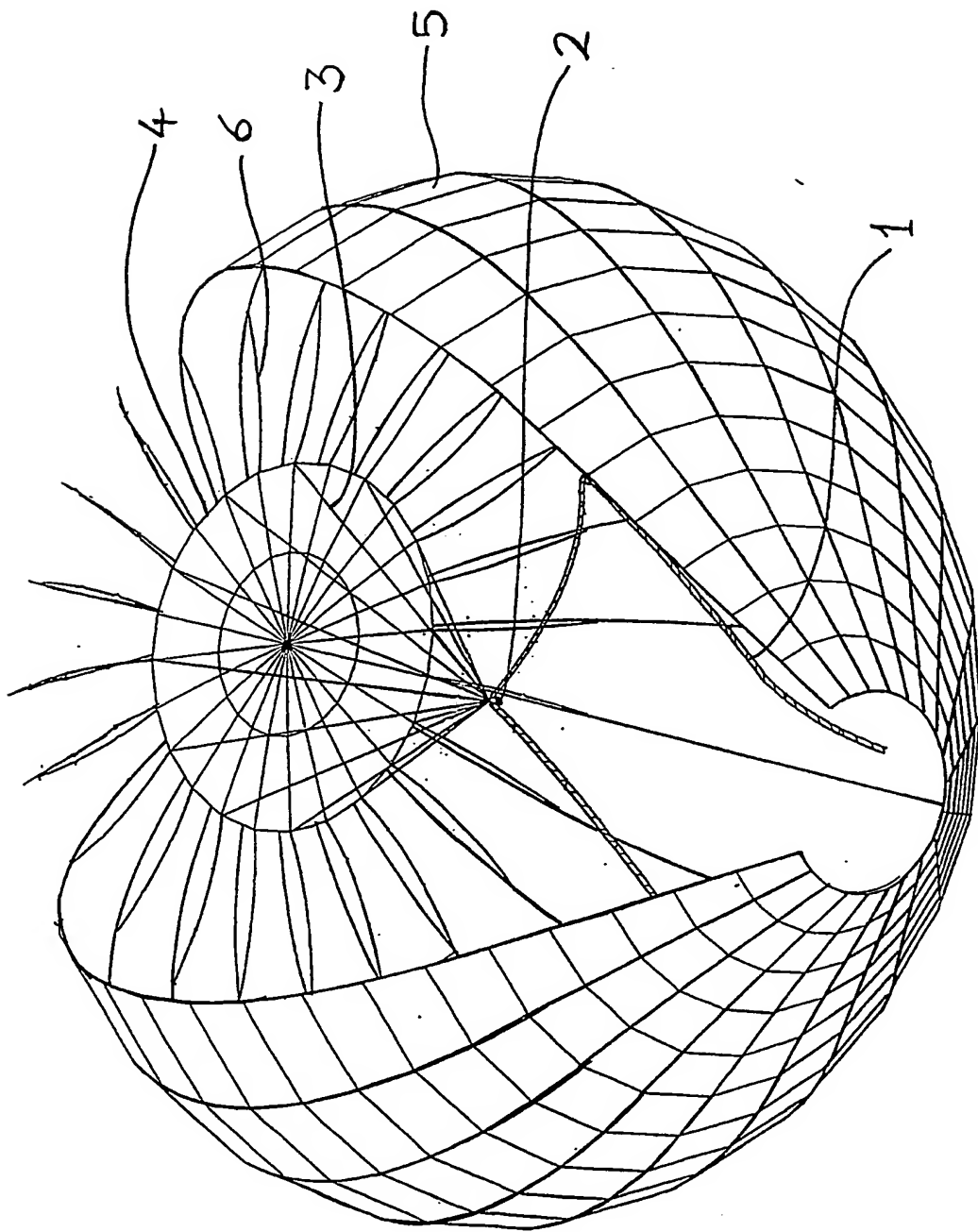


FIG. 1

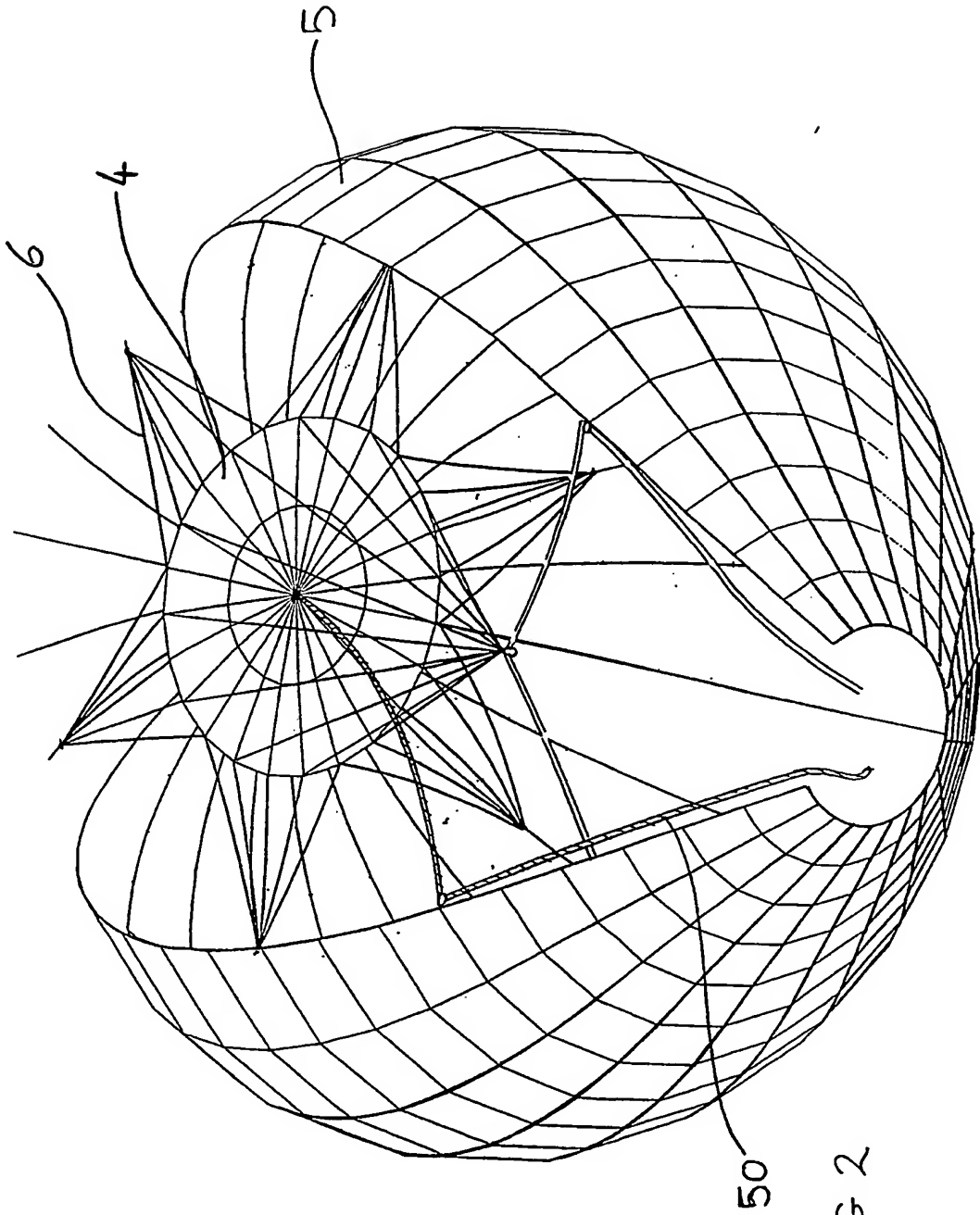
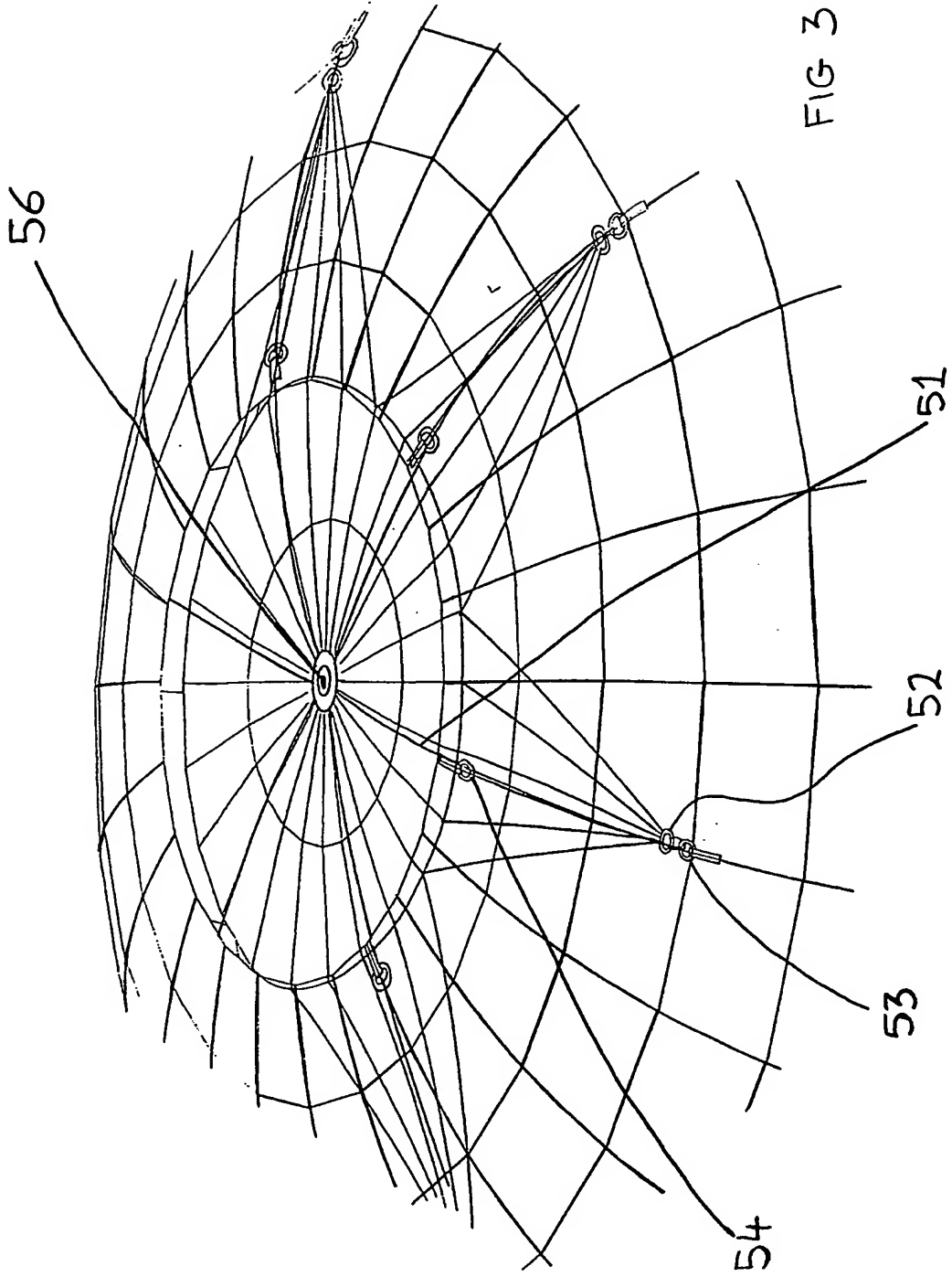
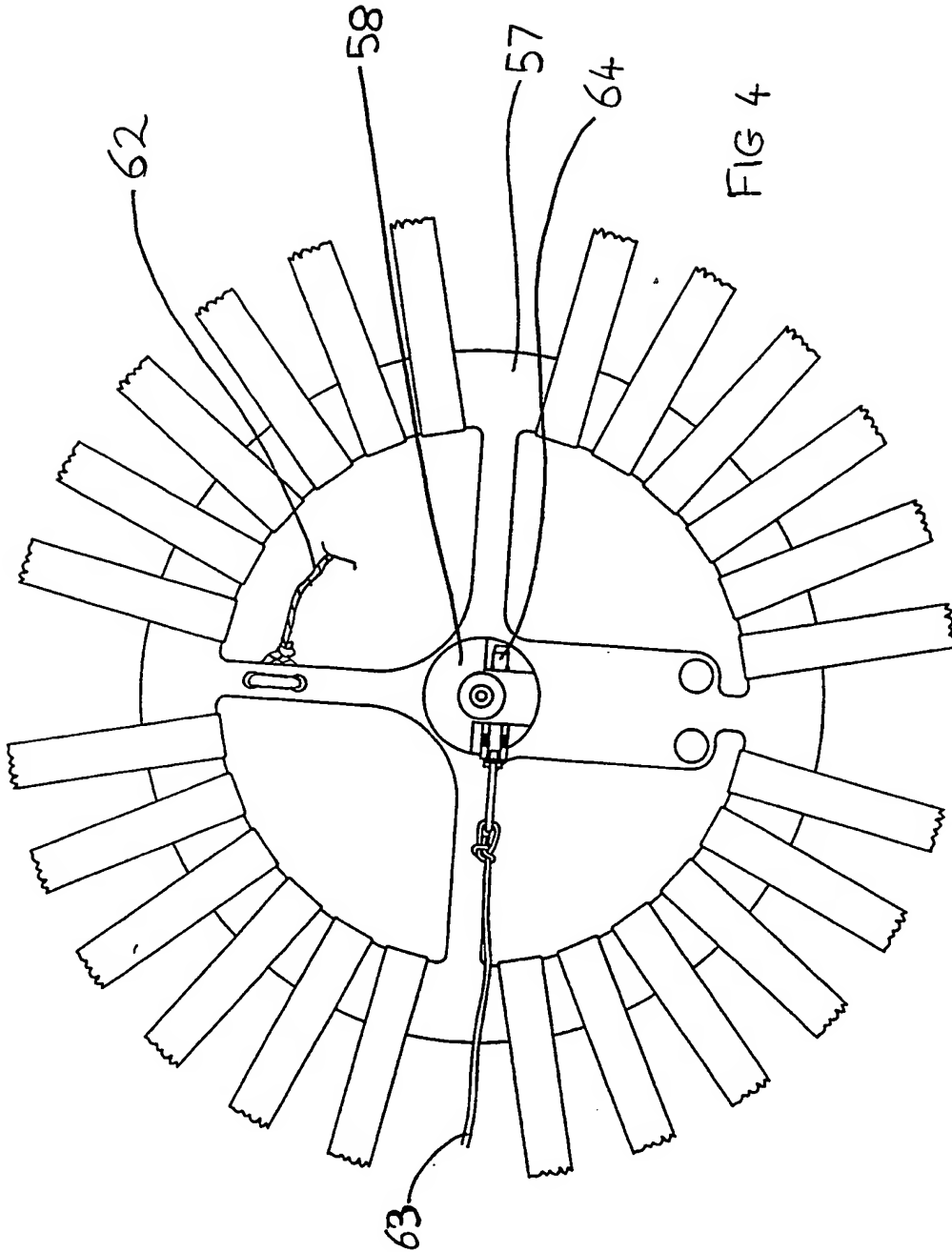
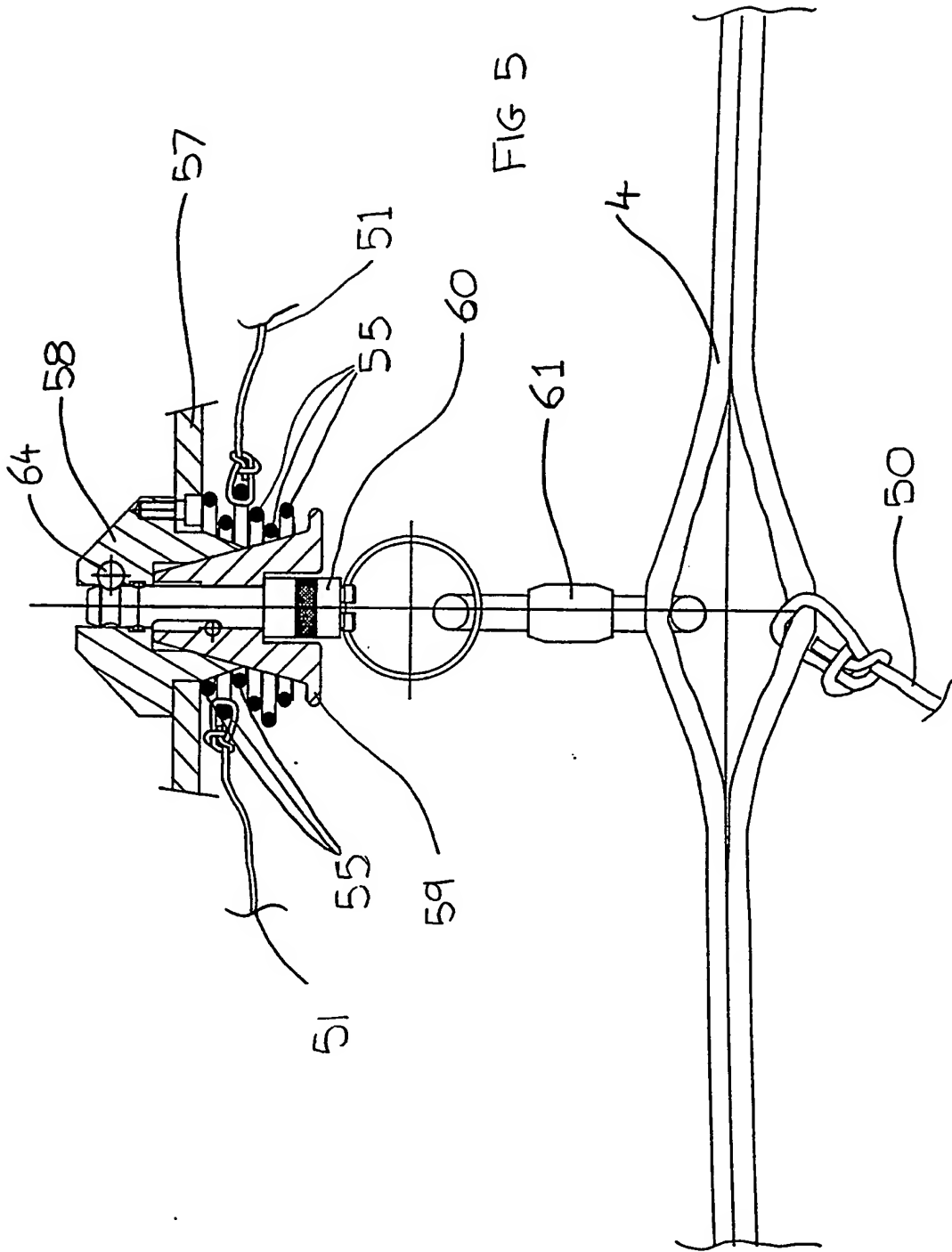


FIG 2







## FAST DEFLATION VALVE FOR A HOT AIR AIRCRAFT

This invention relates to a fast deflation valve for a hot air aircraft.

Aircraft which derive their lift from hot air are normally equipped with a device for permitting the release of hot air. One commonly used device is the parachute valve which is shown in Figure 1. It is operated by pulling on the parachute line 1 which causes the centrally located pulley 2 to move downwards. This transfers tension into the shroud lines 3 and pulls the edges of the parachute 4 downwards away from the envelope 5. The hot air can then pass through the resulting hole. The parachute 4 is held concentric with the hole by the presence of retaining lines 6.

When the parachute line 1 is released, the internal pressure within the envelope 5 causes the parachute 4 to return to its original position, thus sealing the hole from further escape of air. This type of deflation system is satisfactory for most situations, but for landings in high wind speeds a faster deflation system is necessary as an option.

According to the present invention, there is provided a fast deflation valve for a hot air aircraft comprising of an operating line 50 running from the crew carrying gondola up to and attached to the centre of the parachute 4, an adapted parachute assembly to permit the lengthening of the edge retaining lines 6, locking lines 51 which connect the outer ends of the retaining lines to a centrally located lock, a lock which permits the simultaneous controlled release of the locking cords, a link between the operating line and the lock permitting the activation of the lock.

A specific embodiment of the invention will now be described by way of an example, with reference to the accompanying drawings in which:

- Figure 1      Cut away view of hot air balloon showing parachute valve details - current art.
- Figure 2      Modifications to retaining lines for fast deflation valve.
- Figure 3      Details of rigging lines for valve.
- Figure 4      Plan view of crown ring showing arming system.
- Figure 5      Sectional view of lock with attachment to parachute.

Referring to Figures 2, 3, 4 and 5, the fast deflation system comprises a parachute in which the retaining lines 6 have been grouped together and attached to a ring 52.

Also attached to this ring 52 is a locking line 51 which is led through a guide ring 53 situated on the envelope, back up the balloon towards the apex, through a stopping ring 54 situated on the envelope, just inside the parachute aperture, through the parachute aperture and terminates in a ring 55 which provides an attachment method to the lock 56. For each group of retaining lines there is one locking line, resulting in six locking lines in this example.

A lock 56 is incorporated within the crown ring 57, as shown in Figures 4 and 5. The lock is comprised of a crown ring 57 adapted to provide a central hub to carry the lock, an upper half 58 and lower half 59 of the lock and a modified quick release pin 60 which is securely attached to the lower lock half. An attachment 61 is made between the lower lock half and the outside centre of the parachute 4. The operating line 50 is attached to the inside centre of the parachute. The six rings 55 on the ends of the locking lines 51 are retained in position by being sandwiched between the two lock halves.

A stopping cord 62 is provided between the crown ring 57 and centre of the parachute 4. A separate arming system is provided which is comprised of an arming line 63 running from the crew carrying gondola, through guide rings (not shown) attached to the side of the envelope, through the parachute aperture and terminating in an arming pin 64 at the apex of the envelope. The arming pin 64 is inserted through the upper lock half 58 such that its presence prevents the release of the quick release pin 60.

Operation of the fast deflation valve is achieved by first removing the arming pin 64 by pulling on the arming line 63. Once the arming pin has been removed, the operating line 50 is then pulled causing the centre of the parachute 4 to move downwards. This movement is transferred through the parachute 4, into the link 61 between the parachute 4 and the lock 56, thus causing a downward movement of the ring attached to the quick release pin 60. This downwards movement causes the release of the locking balls, thus permitting the separation of the two halves of the lock 58 and 59.

With the lock separated, the locking lines 51 are free to move radially away from the lock 56. This permits the centre of the parachute 4 to be pulled down further, thus causing the edges of the parachute to approach the centre of the envelope.

Once the edges have reached the centre of the envelope, the parachute 4 is in the general shape of a tube, revealing a large hole for hot air escape. Further downwards, movement of the parachute is prevented by the stopping cord 62. The rings 55 on the ends of the locking lines 51 move outwards away from the lock 56 until the stopping rings 54 are encountered. The stopping rings 54 prevent any further outward movement of the locking lines 51.

Re-assembly of the valve consists of retrieving the centre of the parachute 4 by pulling on the stopping cord 62 towards the crown ring. The locking lines 51 are retrieved from their resting position on the stopping rings 54 and placed over the lower lock half 59. Once all the locking lines are correctly positioned, the lower lock half 59 is inserted into the upper half 58. The arming pin 64 is replaced in the appropriate hole.



## CLAIMS

1. A fast deflation valve for a hot air aircraft comprising of an operating line running from the crew carrying gondola up to and attached to the centre of the parachute, a parachute adapted to permit the lengthening of the edge retaining lines, locking lines which connect the outer ends of the retaining lines to a centrally located lock, a lock which permits the simultaneous controlled release of the above locking lines, a link between the operating line and the lock permitting the activation of the lock.
2. A fast deflation valve for a hot air aircraft, as claimed in Claim 1, wherein the lock is incorporated within the crown ring on the outside of the envelope to simplify re-assembly after operation of the valve.
3. A fast deflation valve for a hot air aircraft, as claimed in any preceding claim, wherein the lock is controlled by a standard quick release pin to simplify re-assembly.
4. A fast deflation valve for a hot air aircraft, as claimed in any preceding claim, which is provided with a permanent attachment between the crown ring and the outside of the parachute to control the distance that the parachute may be withdrawn into the envelope and to provide a means of retrieving the parachute from inside the envelope for re-assembly.
5. A fast deflation valve for a hot air aircraft, as claimed in any preceding claim, wherein an attachment means is provided on the envelope just inside the parachute aperture to control the movement of the locking lines away from the lock, thereby permitting simplified retrieval of the locking lines for re-assembly.
6. A fast deflation valve for a hot air aircraft, as claimed in any preceding claim, wherein an arming device is incorporated to prevent inadvertent operation of the valve.
7. A fast deflation valve for a hot air aircraft, substantially as described herein, with reference to Figures 1 - 5 of the accompanying drawing.

**Patents Act 1977**  
**Examiner's report to the Comptroller under Section 17**  
**(The Search report)**

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**Relevant Technical Fields**

- (i) UK Cl (Ed.M)      B7W (WBA, WLB, WLD, WLX)  
(ii) Int Cl (Ed.5)      B64B (1/00, 1/40, 1/58, 1/62, 1/64)

Search Examiner  
KARL WHITFIELD

Date of completion of Search  
28 SEPTEMBER 1994

**Databases (see below)**

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-  
1-7

(ii) ONLINE DATABASE: WPI

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- A:** Document indicating technological background and/or state of the art.      **&:** Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages	Relevant to claim(s)
A	GB 2260956 A      (CAMERON) whole document relevant	
A	GB 1542095      (CREVZET) whole document relevant	
A	US 4651956      (WINKER) whole document relevant	

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